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ABSTRACT

New technologies of information handling are going to produce fundamental changes in the social structure. If we accept the statement that the book "upset the educational monopoly of the Church," we inevitably wonder what monopolies may tumble in the electronic wake of the computer. We are not dealing with a simple difference of degree but, rather a difference of kind. It is always tempting to try to gain reassurance by pointing out similarities between an innovation and our accustomed way of doing things, but it is false reassurance when we are faced with a change in kind and still act as though we were in complete continuity with the past. The major contribution to the history and philosophy of science made in the last ten years is that science is not an unbroken, steady accumulation of knowledge that continuously adds to our understanding of natural phenomena. Today we are faced with this kind of disjuncture with the past. (Other papers from this conference are available as LI 003360 - 003383 and LI 003385 through LI 003390) (Author/NH)

SOME SOCIAL CONSIDERATIONS OF NETWORKING

A paper prepared for the

CONFERENCE ON INTERLIBRARY COMMUNICATIONS

AND

INFORMATION NETWORKS

prepared by

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SOME SOCIAL CONSIDERATIONS OF NETWORKS ING

Anticipating McLuhan by a number of years, Franklin Delano Roosevelt asserted the difference between electrical and mechanical energy in terms of organizational influence on society at the World Power Conference of 1936:

> Now we have electric energy which can be and often is produced in places away from where fabrication of usable goods is carried on. But by habit we continue to carry this flexible energy in great blocks into the same great factories, and continue to carry on production there. Sheer inertia has caused us to neglect formulating a public policy that would promote opportunity for people to take advantage of the flexibility of electric energy; that would send it out wherever and whenever wanted at the lowest possible cost. We are continuing the forms of overcentralization of industry caused by the characteristics of the steam engine, long after we have had technically available a form of energy which should promote decentralization of industry. (Carey and Quirk, 1970)

Under government auspices, the area served by TVA to some extent reflected FDR's position, but, on the other hand, the mechanical and electrical energy of Hoover Dam combined to allow Los Angeles to defy geography and become the largest city on the west coast. Nor is Los Angeles itself the model of the centralizing influence of mechanical energy that FDR hinted at and McLuhan later proclaimed. The automobile dominated Los Angeles and the city is as anarchic as the device it is dependent upon. The irony of the late president's statement is that the very flexibility of electrical energy <u>permits</u> further centralization if this is what we want and that's the way our political and social structures push us. Bruner's famous geography lesson where he gives students a map showing natural resources and physical characteristics of the land and then asks them to locate major cities is fifty years out of date. Modern technology can

destroy geography -- unfortunately in the literal as well as figurative sense. The point is that our <u>hopes</u> for a new form of energy are often confused with the dynamics of the innovation in interaction with the existing social structure and human wants. Electric energy <u>has</u> transformed the United States but in the direction that Innis first, then McLuhan, have indicated rather than the physical decentralization that Roosevelt (more likely his planners) hoped for.

We are in this situation in regard to networks. Energy is information -- and electronics is not only literal information but interactive as well. It is the responsiveness, the interactiveness, added to the all-at-onceness of electricity that creates the powerful energy system of information networking, with the consequent capability of transforming society. However, in attempting to identify possible transformations, we tend to extend into the future present trends within our own institutional frameworks. In addition, what seems important to <u>us</u> in this new capability, may not be important to someone ten or twenty years in the future. It is tempting to substitute in the Roosevelt quote the words "electronic information" for "electric energy" and all other means of information handling for "steam locomotive." Then, if we substitute "libraries" for "factories" and rewrite the paragraph accordingly, we have one forecast of an institutional change that would startle many of us. (The revised paragraph is more likely to be verified by the future than the original!)

This conference is concerned not only with the technology of information exchange but also with the organizational and social structures of present and future networks. The blue sky of the papers

dealing with the technology of information handling clouds over somewhat when future social implications of networks are discussed. For example, we tend to assume that libraries will be the focal points of networks. This is not at all certain. Other networks exist, (the telephone, cable television, etc.), others will, and the structure that may evolve may be a thorough mix of several or all of them. Cable television, in private hands, could become the dominant network, in terms of the public, with library network nodes as auxillary suppliers. At the other end of the transmission spectrum, satellite systems may become the meta-network, subsuming many earth-bound networks. If I may mix metaphors, McLuhan's global village is on the horizon. Becker and Olsen (1968) in defining a network presuppose the existence of units waiting to be interconnected. This no doubt is true now but the dynamics of information handling will generate the units to be joined. Peter Drucker (1968) sees knowledge as one of the major growth industries of the future; if he is right, private enterprise will likely move in to dominate this aspect of networking. The patterns are by no means as set as a reader of the papers at this conference would infer.[1] [The text and context of the rest of my paper may refer to and imply "libraries" but the reader should keep the warning of this sentence in mind.]

Eras of scientific development have been characterized by dominant and overarching metaphors which determine the pattern of model analysis during the period. The era of scientific conceptualization that started phasing out at the beginning of the twentieth century has

been characterized by the dominant metaphor of mechanism. (Meadows, 1957) The models that were used reflected the dominant metaphor, with some variation of the clock favored because it so clearly represented sequential, dependent actions and was absolutely predictable. Adherents of a particular mechanical model often criticized users of other mechanical models, as when Lashley derided Freud for developing "psychohydraulics." (Deutsch, 1952).

The present era of scientific conceptualization has been characterized as organicism. The whole is treated rather than its units. Bertalanffy (1956), the originator of general systems theory, claims that the era of mechanism was concerned primarily with analysis while the present era of organicism is occupied with synthesis, with putting the world back together. During the prior period the sciences were individuated but now the more fruitful investigations are carried out by merging several fields. The emerging science of ecology is an elegant expression of the metaphor of organicism. According to Simon (1954), the same phenomenon is occurring in the social sciences:

> The social sciences. . .weakened by a half-century of schisms among economists, political scientists, sociologists, anthropologists and social psychologists. . .are undergoing at present a very rapid process of reintegration. This development is so rapid, and so obvious from even a casual survey of the journals and new books in these fields, that it hardly requires documentation.

In applied sciences, our concern with thinking in terms of "systems" is a manifestation of the same metaphor. Networking is inherently a systems concept.

It should come as no surprise, therefore, that the device most often used as a symbol of organicism is the computer. McCollough, the late mathematician, once described the computer, in its more sophisticated uses, by using the Greek derived word "anastomotic", where inputs can be treated both as individual entities and as woven wholes. (N.F.B., 1962) The models of organicism are parallel rather than linear in operation and tend to result in probabilities rather than certainty. Bertalanffy specifically rejects vitalism in biology and Oppenheimer (1966) has rejected teleology in physics:

> From this follow all the well-known features: the ineluctable element of chance in atomic physics based, not on our laziness, but on the laws of physics; the end of the Newtonian paradigm of the certain predictions of the future from the knowledge of the present.

I believe that networks as expressions of organicism will reflect these characteristics in their process of becoming.

The distinction made by FDR was really between the two metaphors. Couching one facet of this distinction in modern terminology, the statement may be made that the territoriality of electronics is distinctly different from that of mechanics. By territoriality, I mean where decision points are located, who makes them under what kinds of restraints and constraints, who goes to whom for what purposes, and what kinds of structural relationships are appropriate.

I'll illustrate this point with an example from education. The territoriality of the teacher, on whom we rely in education and in whom we have invested pretty complete authority, is the classroom and the school. When we started to consider ways in which enriched educational

programs could be offered to more students, we automatically put two compatible territorialities together to solve the problem: the school bus (mechanics) and the school. In other words we transport the child to the territory of the teacher. The consequent journeys have become so time consuming in certain areas that, ironically, the all-at-onceness characteristic of electronics, in the form of radio and television, is used to instruct the child while he travels to his teacher's territory, where his "real" education takes place. What makes the territoriality of electronics the servant of the territoriality of the teacher is the authority we have invested in the latter. Remove the authority and the rules of the game change. Electronics is putting the pressure on to do just that. When Marshall McLuhan read the report of the Commission on Instructional Technology, he promptly sent a letter to Sydney Tickton, of the Academy for Educational Development, the agency that had the grant that financed the Commission. Because the letter is so pertinent to this point (and by extension libraries reflect the same problem) I'll quote it in its entirety (AVCR, 1970):

> Dear Mr. Tickton:
> You may have noted that with Xerox the publishing industry has been put into the hands of the reading public. The Report by the Commission on Instructional Technology belongs to the age of mechanical industry and, indeed, of the horse collar, as witness page 7 where it speaks of "harnessing technology to the work of schools and colleges."
> The first motor cars had buggy-whip holders and that is the stage which your report has achieved. The meaning of the electric age is the switch from "hardware" to "software." It means that all instrumentation is to be taken from the hands of the instructors and put into the hands of the students for programming. All electric technology is basically as decentralist as the telephone. The computer means the return to the "cottage economy," i.e. run your factories from your

> cottage. The age of bricks and mortar, schools and colleges, is as finished as the Paramount Studios in relation to the movie industry, and for the same reason -- speed-up. The environment itself has become a teaching machine. Education is now by immersion. All things are now learned as our native tongue, by immersion. Subjects and specialties are over as we move into the new Stone Age of the hunter -- the man who plays the total field -- the Cyclops.
>
> I do not endorse or desire any of these changes. They have already taken place. The U. S. A. is the one country in the world that began its existence on the Gutenberg basis. This fact puts it in the worst possible position in the age of electric circuitry. It has more to lose and more to change than anybody.
>
> Marshall McLuhan, Director
> Centre for Culture and Technology
> University of Toronto

The parallels between schools and libraries as similar kinds of public institutions may be instructive. The printing press established the territoriality of the library. Networks as an expression of the new technology of information handling will in all probability generate a territoriality quite different from that of the book. At present we tend to look in the rear-view mirror of our new technology and fit it, like the buggy whip, into the old technology. The second generation of the new technology will start breaking the old territoriality apart, when and if incompatibility surfaces. When television and language laboratories were first introduced into schools, educators forced both into the old patterns by treating them as electronic classrooms. The second generation of each, in the form of random access and other communications systems, with the aid of computer administered instructi is breaking the classroom apart.

Some critics of education maintain that education is still a cottage industry in industrial parlance and a craft industry in relation to technology. If so, education could leapfrog from pre-industrial cottage to past-industrial cottage. Peter Drucker in

conversation with Robert Snider of NEA referred to education as a <u>pre</u>-craft culture, then warned that chaos could result from injecting sophisticated technology into that primitive a society. The libraries are in somewhat the same situation, except that the introduction of sophisticated technology will not represent as direct a job threat as it does to teachers. In the first place there is likely to be little direct challenge to established decision making except perhaps to the head librarian but even here decisions and authority retained by the local center will be of a different order than those made at nodes. But more importantly, networks will represent primarily expanded service opportunities of a different order, which as I mentioned before may not always function within established libraries. Much more interesting is the relatively sudden advent of a hierarchy of positions within the field itself. More of this later.

The vast majority of the papers at this conference are preoccupied with what Rupert Hall (1963) refers to as the technical act, which can be briefly described as the combination of technological process and the resultant products of the process. By technological process I mean the ability to analyze and subdivide tasks into their component parts and devise <u>replicable</u> solutions. By technological products (or just products) I mean the instruments created by the technological process that permit replicability. Devising a computer program is an example of technological process; the program itself is the product. We need to keep in mind that software as well as hardware are technological products.

It is clear that we are becoming highly proficient at the technical act and designing extremely sophisticated technical products all along the line of network development. However, an essential condition for a successfully implemented, universal technology is the existence of a facilitating environmental structure that welcomes and encourages technological change of a fundamental nature. Encouragement must occur at the developmental stages, implementation stages, and among the professional community concerned.

The developmental stages are reasonably financed now when we consider the many inputs into the research and development system. Private as well as public money is busy developing the various technologies necessary, although no doubt much more is needed and much more is likely to be allocated. The importance of development money is easily seen by federal agencies and by congress because the nation has a history of stepping in to help finance large scale R & D operatio when the price is too high for industry. Atomic energy, satellites, and the super-sonic transport are examples of acceptance of governmenta responsibility for research and development in enterprises too large for private investment. The post-World War II alliance of government, industry, and university (or non-profit research institute) has paid off handsomely in terms of scientific and technological development. It is reasonable to expect the same helping hands to continue to develop network technology.

As a result, research and development in general have become so closely related, and so systematically treated, that the time span

between discovery and implementation has been reduced dramatically. For example, while it took 65 years for the electric motor to be applied to practical tasks, and the vacuum tube 33 years, the transistor was in use just three years after its discovery. The laser experience parallels that of the transistor. (Baker, 1964) We can expect the same rapid rate of development in network technology.

Creating a facilitating environment for implementation is a more difficult problem, particularly when dealing with public institutions. The private sector of our society generally finds our economic and political structure encouraging to technological innovations. I am referring primarily to laws and regulations that either encourage or discourage the introduction of new techniques. High on the list of discouraging factors are codes and restrictions imposed by unions. The most cited examples being the building codes. On the other hand straight wage demands increase the pressure to develop more productive techniques. However, by and large our political and economic structure is friendly to technology.

Sometimes it is too encouraging:

> The Army recently denied permission for a private dredging-and-filling operation in navigable waters of Florida, responding to the argument of health and conservation agencies that the project would injure fish and wildlife. A Federal court overturned the decision on the ground that the law makes interference with navigation the only basis for refusing permission to dredge and fill. (Brooks and Bowers, 1970)

One of our obvious problems today is that we have too encouraging an environment for technological growth in the private sector. The Federal government has sponsored several studies to study how new technological innovations may be assessed for long term effects. However, the public sector faces a different situation.

The metaphors of clock and computer are not restricted to scientifi eras. As Dwewy once pointed out, metaphors have a way of becoming all pervasive so that the social and philosophical rubrics of society exhibit the same evolution. The quest ~~of~~ for certainty in philosophy lost dominance ~~about~~ during the same period that saw the beginning of the end of Newtonian mechanics. The arts are our "distant early warnings systems" that alert us to emerging reorientations of our societal patterns.

We should expect then that the political and social institutions that evolved during one era may not be appropriate in another. This is easily seen and acceded to in minor laws and regulations, or when someone else's vested interest is involved. But sweeping, fundamental disjointedness and threats to security, identity and power are not readily seen or agreed to. For example, one of the most serious questions that has been raised is whether the Consitution of the United States is appropriate to changing demands placed on it. But a movement to adopt a new constitution, such as the one proposed by the Center for the Study of Democratic Institutions, will understandably have hard, if not impossible, going. The issues here are not of this magnitude but some ~~way~~ are equally difficult to effect. But a formal, systematic examination of the political, economic and social structures that may not facilitate networking needs to be undertaken. At present a piecemeal approach is being used -- from copyright to local tax structures.

Public institutions operate under heavier restraints than do private ones. The rigidity and extent of the laws and regulations vary from state to state. They also vary with the kind of institution governe

For example, the schools are no doubt more tightly locked in than public libraries. Fundamental changes in education are difficult to effect. Many innovative programs exist because of federal money but and withdrawal of that support would see the end of the programs. Title III of the Elementary and Secondary Education Act sponsored many large scale innovations but the mortality rate after Federal funds stopped has been high, partly because state and local structures did not permit institutionalization of the programs. Libraries may be facing this same problem in regard to networking.

Maryann Duggan has commented to me that in the preparation of her paper she discovered that what they are doing in Texas may be illegal. If so, it is best to challenge the law if necessary to get a change. This reminded me of the early days of community television services by way of translators. While the FCC was trying to make up its mind about their legality, the late Senator Edwin C. Johnson of Colorado simply ordered them installed in his home town. It was years before the FCC finally gave the go-ahead.

Territoriality is protected by men and institutions operating within the superstructure that evolved out of certain fundamental relationships and forces. Not only laws and regulations but also prerogatives based on a tradition contribute to the superstructure. An interesting example of how the direction of network services will be pushed by the dynamics of territoriality is provided by a brief report on the Association for Graduate Engineering and Research of North Texas (TAGER), a television network. (Perraton, 1969)[77] First, the purposes of TAGER:

> The TAGER system was set up for two different but related reasons. First, it was intended to enable the co-operating institutions to share teaching, for use on their own campuses. Second, it was designed to extend the scope and raise the quality of engineering teaching at graduate level in North Texas. The engineering teaching on the network is aimed at graduate engineers, who have gone into industry with a bachelor's degree and now want to take a master's or a doctorate. The Southern Methodist University Institute of Technology is thus using technology in order to extend its functions in continuing education.

Then, the experience:

> The TAGER network has been used very much less for exchanging teaching internally between its members. But three of the ways in which it is being used seem of major importance. First, it has enabled the SMU Institute of Technology to avoid establishing one department on its campus. The Institute has no aerospace department, but there is one at the South-West Center for Advanced Studies (SCAS), a research institute run on university lines. Instead of creating his own department, Dean Martin has therefore arranged for the aerospace staff at SCAS to hold associate membership of the staff of the Institute of Technology and to teach his students principally over the TAGER network.

An inference of the report is that the continuing education of engineers already in the profession has nowhere near the territoriality strength of training for entry into the profession by each institution. (This is related to a point made later in the section on personnel) If the reader will think along these lines for a moment, he will understand why offices of correspondence instruction (or continuing education) have had virtually no influence on the instructional program of the universities which house them.

One other observation. Dean Martin of SMU made his operation more cost effective by using the resources of other institutions rather than duplicating them. But his decision would have been extremely difficult to make if he had had even one staff member as an Aerospace department.

Territory would have been established. If a department had been established before TAGER started, it is not likely to have voted itself out of existence, or voted for transfers to other institutions regardless of cost benefit possibilities. Decisions of that kind have to be made at administrative levels. Very frequently when we discuss diffusion and adoption we don't make adequate distinctions between levels of decision making. We often waste a lot of time trying to get the wrong level to adopt an innovation.

Centralization and Decentralization

McLuhan maintains that electronics is decentralizing. He is right if he is referring to the ability to be and go everywhere and to the uniform distribution of culture. However, there is an element of centralization in terms of control and planning; enough to make many people leary of the implied power.

Actually two characteristics of systems based on organismic models help keep a balance between centralization and decentralization: more inclusive representation in initial planning stages; and shared power and decision making all along the line.

As a system becomes more comprehensive and technologically oriented, more far-reaching decisions have to be made by more people earlier in the planning stages. When decisions are made, parallel rather than linear operations are carried out. In a mechanistic model decisions are sequential and discrete -- the problem is passed along step by step. In an organismic model, a much more representative group from up and down the line participates in planning and decisions making right from the start and operations are carried out in parallel.

This leads to the second characteristic which is shared power during the operational stages. By shared power I mean that units tend not to carve out exclusive territories and operate them arbitrarily. Because they are dependent on each other they tend to share decision making. I believe, for example, the nodes of an existing network would confirm this position.

In general, contrary to generally held opinion, large scale technology allows the individual to exercise greater responsibility and increases the possibilities of public control. (Mesthene, 1969, 1970)

Networks and Instruction

I tend to agree with Dan Lacy (1969) in Social Change and the Library, 1945-1980 that the most widely discussed use of computer -- retrieval, as the term is generally used -- may be least significant with respect to the general public.[2] /[2]Minor, or incidental, intelligence, which I suppose is the public's major storage and retrieval need, is now taken care of quite nicely by a telephone call to a reference librarian. If the network removes the librarian and fails to hook into my phone, my modest demands are going to be much harder for me to satisfy. It very well may be worth paying the telephone company for the service.

On a larger scale, and with more specialized audiences, ERICs are supposed to make documents readily available but the complications and hardships of use result in all storage and no retrieval. There is a parallel to our transportation system here. Information flashes from

center to center at an incredible rate but it has a hard time with the final leg of the journey.[17] It is quite possible that formal (with accreditation) and informal instruction may become the most important aspect of networks to the general public. Advances in instructional technology, diversity of instructional demands by very disparate groups, and the inability of the present educational system to adjust to demands are some of the more important pressures that may change drastically the institutional framework of future instruction.

I mentioned earlier that the territoriality of the classroom teacher is incompatible with that of electronics. The development of electronic distribution systems, the computer, and advances in techniques of organization of instruction, particularly programed instruction, combine to allow us to instruct successfully by separating teacher and student in distance and in time. Disregarding the social function of the school (which we can't), very little of what the student learns cannot be taught by instruction incorporated into electronic systems. Some of you not familiar with developments in Computer Administered Instruction (CAI), which combines the power of electronics with response oriented programed instruction, may believe that only low level cognitive skills may be taught in this fashion. Not at all. CAI is being used very successfully in instructional situations requiring problem solving, decision making, and other complex skills. At present, this instruction is very expensive but amortization over a large number of students can reduce the cost to very acceptable figures. Networking is an obvious way of reaching the optimal number of students. The same point can be made about cost/

effectiveness in regard to television -- another network. So far, neither has been able to penetrate school districts, or colleges for that matter, to any appreciable extent. As mentioned earlier, The Association for Graduate Engineering and Research of North Texas (TAGER) is one operating network that <u>has</u> started to make inroads into traditional territories with some savings in instructional costs. A few places, such as Pennsylvania State University and Dade County, Florida, have increased instructional productivity with television but to the vast majority of educational institutions this form of instruction falls into the luxury category -- very nice to have if you can afford it and if the latest bargaining session with the teacher group didn't squeeze it out of the budget.

Hall (1963) in commenting on the problems of introducing advanced technology into underdeveloped countries postulates that to be successful there must be "an industrial framework within which the kinds of changes that may be effected by science are not only useful but acceptable." He goes on to say that:

> Scientific knowledge is of little material value if the object of technological proficiency is the manufacture of objects of luxury; hence in backward contemporary societies the arbitrary installation of a few modern industrial plants, without modification of the basic economy, has little more result than to allow the rich to adopt Cadillacs and television in place of more barbarous means of ostentation.

Drucker (1968) claims that information will be a growth industry of the future but indicates that increased productivity in education must occur first:

> Learning and teaching are going to be more deeply affected by the new availability of information than any other area of human life. There is great need for a new approach, new methods and new tools in teaching, man's oldest and reactionary
> most

> craft. There is great need for a rapid increase in learning. There is, above all, great need for methods that will make the teacher effective and multiply his or her efforts and competence. Teaching is, in fact, the only traditional craft in which we have not yet fashioned the tools that make an ordinary person capable of superior performance.

The new technologies of instruction are the obvious means of achieving the goal of "multiplying" a teacher's efforts through network distribution, thereby securing favorable cost/effectiveness figures mentioned before.

But the "basic economy" of education tends to prevent the introduction of sophisticated technology and without revision technology will remain peripheral to the enterprise. "Basic economy" in education should be translated into the base of education -- the fundamental premises on which it is structured and in whom authority is vested. The laws, regulations, and policies that form the superstructure of education are designed to reinforce and support the base. The elaboration of a superstructure over a period of time was necessary to assure quality education <u>within the accepted framework</u>. But it is a superstructure that does not encourage or facilitate technological solutions to problems.

Due to a number of pressures, such as taxpayer resistance and teacher militancy, cracks may start appearing in the superstructure.[3] [[3]For a more elaborate discussion see Heinich (1970).] Just a few of the basic edifices need to be removed to set in motion forces that could radically alter the institutional relationships in education. For example, if accreditation were based solely on student performance

regardless of where he receives instruction, the door would be wide open for other agencies to get into the business of instruction. If, at the same time, state aid formulas were changed so that money would be distributed solely on the basis of students, or if the voucher syste really became a reality, profit making groups as well would start offering a wide range of instruction. This is not as far fetched as it may seem. The courts are deciding a case that may presage a series of decisions that could fundamentally alter education. Marjorie Webster Junior College, a profit making institution, is suing the Middle States Association of Secondary Schools and Colleges, a regional accred agency, because the association refused to evaluate the institution for accreditation. So far the courts have ruled in favor of the junior college, throwing out the association's claim that its charter prevents it from accrediting profit making institutions. The court held the association was acting in restraint of trade. Marjorie Webster is a resident junior college but the reasoning of the court could easily extend to non-resident instruction as well. If it does, and someone is sure to enter a test case, a major step will have been taken to create an environment encouraging to instructional technology.

Instruction will be available wherever the terminal is and where the terminal will be located depends on the responses of the institutio involved. Special courses leading to specific jobs, courses designed to prepare people for the next rung on their career ladders, and course simply to maintain competencies are examples of the kinds of instructio that will eventually be handled by some sort of networking operation.

In addition, because of the foregoing argument, courses which we now associate strictly with formal schooling will be incorporated in the resources of some form of network; courses that will apply toward degrees and various forms of certification. The "open university" idea in England would fit easily into this same framework. These are some of the reasons why I believe that instruction will be one of the main functions of networks. The question is where will the terminals be located.

The public library is one logical choice. If the schools prove to be unresponsive, the public library system is the other main public institution that is widely distributed and can provide the necessary atmosphere, both social and academic. The phenomenon of store front schools may spread rapidly. So far these efforts have been tentative and relatively poorly financed. However, the right program with adequate financial backing, and given the encouragement mentioned above, could make a success of a chain of such stores hooked together in a network.[4] [[4]McLuhan's cottage industries!] And we musn't forget cable television. CATV ~~installations~~ centers are being installed that are capable of handling forty some channels. The FCC has forced the CATV industry to view their capabilities in a much broader framework by imposing public service obligations. This reorientation plus the increased capability will put the CATV companies in an excellent position to capitalize eventually on the information industry.

Let's speculate on the possibilities. Suppose a national curriculum group such as the Biological Sciences Curriculum Study (BSCS) were to design a course that by using an interrelated series of films and

programed instruction permits self-study by individuals or small groups. The films would be available over cable television and students would view them in small groups (or individually). The related programed instruction would be available at the end of a terminal in public library (or other institutional setting). Finally, assessment of student achievement and accreditation would be turned over to Educational Testing Service or American College Testing, and carried out over those same terminals. Tuition collected by credit card, naturally. Revisions of the course, would be a periodic responsibility of BSCS, while proposals for additional courses in biology would be entertained constantly. The reader will see other ways of arranging the components but the point is that we are able to build an instructional system of great power and flexibility by networking.[5] [[5] This is simply an up-dating of a concept of the late James D. Finn (1960)]

Some Personnel Considerations

One of the characteristics of advanced technology is that the majority of jobs it creates require higher than average education. In fact as our society has incorporated more sophisticated technology into the industrial and service sectors the character of the whole work force has changed. John Kenneth Galbraith (1966) describes the manpower change in a particularly graphic way:

> In the early stages of industrialization, the educational requirement for industrial manpower was in the shape of a very squat pyramid. A few men of varying qualifications -- managers, engineers, bookkeepers, timekeepers and clerks -- were needed in the office. The wide base reflected the large requirement for repetitive labor power for which even literacy was something of a luxury. To this pyramid the educational system conformed. Elementary education was provided for the masses

> at minimum cost. Those who wanted more had to pay for it or to forgo income while getting it. This insured that it would be sought only by a minority. To this day the school systems of the older industrial communities in West Virginia, central and western Pennsylvania, northern New Jersey and upstate New York still manifest their ancient inferiority. It is assumed that an old mill town will have bad schools.
>
> By contrast the manpower requirements of the industrial system are in the shape of a tall urn. It widens out below the top to reflect the need of the technostructure for administrative, coordinating and planning talent, for scientists and engineers, for sales executives, salesmen, those learned in the other arts of persuasion and for those who program and command the computers. It widens further to reflect the need for white-collar talent. And it curves in sharply toward the base to reflect the more limited demand for those who are qualified only for muscular and repetitive tasks and who are readily replaced by machines.

We can certainly expect that an industry such as information handling will exaggerate an already dramatic situation. The proportion of jobs created that will fall into the category of high educational requirements will be much greater than the average. Bell (1968), characterizing our society as a "knowledge society", shows that within the swelling educated class the greatest growth is taking place in the areas dealing specifically with knowledge. We can expect recruitment problems in the future. We may find, too, that more and more graduate students will look with favor on the field, particularly if our very recent experience of a shrinking job market for Ph.D.s continues. Many graduate students who would never have considered librarianship would be attracted to information sciences.

Perhaps the happiest aspect of the enlarging job market is that these added positions will not eliminate many other jobs. However, two serious problems may emerge, if they haven't already. The first concerns the possibility of creating class distinctions within the field and the other pertains to the necessity of providing upward mobility. The second can help solve the first.

If we consider the whole field of information handling, the new positions that will result will tend to require higher skills than the old. To the people in information sciences traditional library functi(may seem like paraprofessional activities.[6] /[6] I wonder if some of the traditional library schools will require them to take Card Catalog 104. Galbraith (1966) believes that the trend toward differentiation on the basis of education is creating a new class distinction:

> Much may be learned of the character of any society from its social conflicts and passions. When capital was the key to economic success, social conflict was between the rich and the poor. Money made the difference; possession or nonpossession justified contempt for, or resentment of, those oppositely situated. Sociology, economics, political science and fiction celebrated the war between the two sides of the tracks and the relation of the mansion on the hill to the tenement below.
>
> In recent times education has become the difference that divides. All who have educational advantage, as with the moneyed of an earlier day, are reminded of their noblesse oblige and also of the advantages of reticence. They should help those who are less fortunate; they must avoid reflecting aloud on their advantage in knowledge. But this doesn't serve to paper over the conflict. It is visible in almost every community.

I may be setting up a straw man but based on experiences in other fields (including my own) this issue may become a very sore spot. Smooth functioning of network establishment and operation may be interfered with considerably in the process. Some of you may reply that the two groups will probably be separated by distance and therefore friction is not likely to occur. But this very situation is what could cause the most serious kinks in operational activities.

Implied in all the above is the likelihood of the establishment of a career ladder and it should be encouraged. Far better to look at it this way and facilitate rather than inhibit upward mobility. It would be unfortunate if the newer members of the field regard themselve

as an elite and set up artificial obstacles to career mobility. Although we are discussing a higher order mobility problem than the Harvard study (1969) addresses itself to in the following quote, the problems may be quite similar:

> Whatever the nature of the social choices that will be made to help minimize the disruptive effects of technological change and to maintain mobility and fluidity in the occupational structure, technological change in industry has resulted in the blocking of certain older paths of mobility. In industry, because of "the need for managerial personnel to have a broad educational and technological background,...a moat /has been established/ between the workers and their foremen and all other supervisory personnel. It is increasingly rare for a working man to advance more than one step up the managerial ladder. He can become a foreman, but that is all." Mobility in office work appears to be similarly blocked as "the middle step in the old promotion ladder" -- positions requiring experience and seniority, but beneath the managerial level -- appears to be growing smaller with the introduction of automation. And among managerial and supervisory personnel in industry, "a 'gap' is forming between lower and higher levels of management... Yet in the wide number of areas where promotional paths are being modified the extent to which modified job and work environments call for the (technical) degree is not clearly established. There is a clear tendency to overestimate its relevance. In addition, where higher level skills are indicated, the development potential of existing company personnel is frequently overlooked."
>
> Such inability to move up within the hierarchy of an employing organization has been a source of frustration to many workers; and since the blockage often results from exaggerated notions of the importance of formal education, there is an underutilization of existing talents. In many instances on-the-job training has been used quite effectively to permit the existing work force to assume the new roles and responsibilities. Furthermore, in the face of rapid technological change, even recent college graduates suffer from the problem of knowledge obsolescence.

One of the major obstacles to vertical career mobility in the professions is the requirement that full training precede entry into the profession. Even after the individual is admitted into the profession he may not find it easy to advance. What we need are programs

that prepare people for "new careers" as well as programs for mid-career changes.

Keeping in mind that we are looking only for analogs here rather than assuming situations that are ~~exactly~~ the same, the Harvard study continues:

> The "new careers" concept thus focuses on those occupations in which on-the-job training could replace advance preparation. It departs also from the observation that societies need as much health, education, and welfare services as they can afford. There is room for expansion of existing careers in these service areas. Many more people could become qualified teachers, for example, if a process of moving up from the position of teacher's aide through a series of steps allowed them to become certified teachers. In addition, various social service "activities not currently performed by anyone, but for which there is a readily acknowledged need and which can also be satisfactorily accomplished by the unskilled worker" could be developed. The attempt to design new types of careers is thus also responsive to the problem of providing meaningful work for the increasing numbers of workers who will not be able to find gainful employment in the labor force of the future.

We need a program of continuing education available to the interested individual just about anywhere that would prepare him for whatever rung on the ladder he is capable of reaching. <u>If professionals in information sciences fail to use for this purpose the networks they are creating, it will be a classic high level case of the shoemaker's children</u>. The problem of mobility is not simply the concern of the schools of information science, it is a problem of the profession.

In my own field, the Association for Educational Communications and Technology has sponsored a proposal to the U. S. Office of Education to establish a national continuing education program in instructional technology to permit complete career mobility. There is

no intention to replace the professional schools. The program will, if funded, provide advancement opportunities to those people unable to go the more direct route. I think this is a proposal of great vision and I would urge this group to do the same.

Conclusion

> ...we possess, in absolute terms, far greater physical power and technical capability than ever before. It is not necessary to claim that atomic energy represented a greater change than gunpowder to realize that the atomic bomb is more powerful than TNT. Printing might easily have induced a greater social shock than the computer -- it upset the educational monopoly of the Church, for one thing -- yet the fact remains that the computer can deal with far more information almost infinitely faster than printing can. In absolute terms, we have far more power than anybody. (Mesthene, 1966)

Our new technologies of information handling are going to produce fundamental changes in the social structure. If we accept the statement that the book "upset the educational monopoly of the Church," we inevitably wonder what monopolies may tumble in the electronic wake of the computer. We are not dealing with a simple difference of degree but, rather, than one of kind. It is always tempting to try to gain reassurance by pointing out similarities between an innovation and our accustomed way of doing things; and, of course, there are always similarities because all ideas derive from <u>some</u> historical context. But it is false reassurance when we are faced with a change in kind and still act as though we were in complete continuity with the past.

The major contribution to the history and philosophy of science made in the last ten years is that science is <u>not</u> an unbroken, steady accumulation of knowledge that continuously adds to our understanding

of natural phenomena. Kuhn (1962) has advanced the idea that the kind of fundamental discovery that establishes a new research tradition, such as Copernican astronomy or relativity theory, is a break with the past and cannot be accounted for by simple extension of prior knowledge. His theory has gained widespread support among scientific historians.

We are faced with the same kind of disjuncture with the past. We will be far better off by concentrating on the differences between the capabilities we now have and those of a prior tradition. Networking is not just a more sophisticated way of handling information -- it is a radical departure.

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